



## Physical Anthropology Section – 2010

### H93 Prognathism and Prosthion in the Evaluation of Ancestry

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After attending this presentation, attendees will understand the advantages of another landmark, subspinale, as a valid substitute for prosthion in the estimation of ancestry.

This presentation will impact the forensic science community by offering an alternative methodology for estimating ancestry via discriminant function analysis (DFA) of crania when prosthion, a major landmark currently used for this purpose, is unavailable.

The estimation of ancestry is an essential part of the biological profile. Prognathism, expressed in cranial measurements involving prosthion—the most anterior point on the alveolus between the central incisors—is useful in estimating ancestry. American blacks are more prognathic than American whites, and this is especially clear in the relationship between basion-prosthion length and basion-nasion length. Crania that are edentulous or display antemortem loss of the central upper incisors with resorption, or postmortem damage, preclude the use of measurements involving prosthion. When unidentified human remains are concerned, using subspinale as a substitute for prosthion in such cases of edentulous crania has not yet been explored for ancestry estimation. Subspinale is defined by Howells (1973) as the most posterior point on the crest inferior to the anterior nasal spine. In analyzing differences due to ancestry, this study helps to define and identify prognathism and what it entails.

FORDISC 3 (Jantz and Ousley 2005) was used for a Discriminant Function Analysis (DFA) of 102 adult Black males and 83 adult White males from the Terry Collection, a nineteenth century skeletal collection. All individuals were digitized and standard Howells measurements were calculated from the landmark coordinates. In the first set of tests, standard Howells craniometrics were evaluated, including cranial base length (BNL), maximum cranial breadth (XCB), maximum cranial length (GOL), nasal breadth (NLB), minimum frontal breadth (WFB), nasal height (NLH), basion-prosthion length (BPL), and nasion-prosthion height (NPH) from black and white males. Using these measurements, which include ones involving prosthion, FORDISC 3 correctly classified 88% of Black males and 86% of White males. In all, 87% (161 out of 185 individuals) were correctly classified. Very similar results are obtained when using 20<sup>th</sup>-century samples. When measurements involving prosthion were removed, simulating antemortem loss and resorption, the overall accuracy fell to 77%, confirming that measurements utilizing prosthion are especially valuable in estimating ancestry.

Next, basion-subspinale (BAS\_SSP) and nasion-subspinale (NAS\_SSP) were substituted for BPL and NPH, respectively, and analyzed with the six other standard measurements previously used (BNL, GOL, NLB, NLH, WFB, and XCB). In this analysis, the sample size was 103 Black males and 95 White males. With the substitutes, 83% of Black males were correctly classified, while 88% of White males were correctly classified, and overall, 86% (170 out of 198) of individuals were correctly classified. Therefore, measurements using subspinale can be used in place of those involving prosthion with little or no loss in classification accuracy.

In running more analyses with subspinale, morphological differences between Black male and White male subnasal regions became apparent. Black males showed a larger distance between nasospinale and subspinale when NLH and NAS\_SSP measurements were compared. Additionally, morphological differences between Black males and White males were seen when basion was used as an anchor to compare relative projections of subspinale and prosthion. In Black males, the average BAS\_SSP and BPL lengths are 97.1mm and 104.6mm, respectively, a difference of 7.5mm. In White males, average BAS\_SSP and BPL lengths are 92.4mm and 95.8mm, respectively, with a difference of about 3.4mm—less than half the distance seen in Black males. In other words, the average Black male displays about twice as much anterior dental projection, or prognathism, relative to the subnasal region than does the average White male. Another advantage to using subspinale is suggested by the fact that the total sample size increased from 185 to 198 individuals, because some of the sample included edentulous individuals. Additionally, results revealed more specific morphological differences in the expression of prognathism between white and black males. This is a proof of concept study, in that a technique based on a nineteenth century sample is of uncertain validity for twentieth century populations, though we anticipate that similar relationships will be found in twentieth century individuals, the subject of further research.

#### Forensic Anthropology, Ancestry, Prognathism